

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
31 January 2002 (31.01.2002)

PCT

(10) International Publication Number
WO 02/07779 A1

(51) International Patent Classification⁷: **A61K 49/00**,
C07F 15/00

R. [US/US]; 10037 Fox Den Road, Ellicott City, MD 21042 (US).

(21) International Application Number: PCT/US01/23034

(74) Agents: **ZELANO, Anthony, J.** et al.; Millen, White, Zelano & Branigan, P.C., Arlington Courthouse Plaza 1, Suite 1400, 2200 Clarendon Boulevard, Arlington, VA 22201 (US).

(22) International Filing Date: 23 July 2001 (23.07.2001)

(25) Filing Language: English

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(26) Publication Language: English

(30) Priority Data:
60/219,659 21 July 2000 (21.07.2000) US
60/246,954 9 November 2000 (09.11.2000) US

(63) Related by continuation (CON) or continuation-in-part (CIP) to earlier applications:

US 60/219,659 (CIP)
Filed on 21 July 2000 (21.07.2000)
US 60/246,954 (CIP)
Filed on 9 November 2000 (09.11.2000)

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(71) Applicant (*for all designated States except US*): **UNIVERSITY OF MARYLAND, BALTIMORE** [US/US]; 515 West Lombard Street, Baltimore, MD 21201 (US).

Published:
— with international search report

(72) Inventor; and

(75) Inventor/Applicant (*for US only*): **LAKOWICZ, Joseph,**

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: LONG WAVELENGTH LONG LIFETIME LUMINOPHORES

(57) Abstract: A new approach is described to making luminophores which display long emission wavelengths, long decay times, and high quantum yields. These luminophores are covalently linked or otherwise closely associated pairs with a long lifetime resonance energy transfer (RET) donor e.g., a ruthenium (Ru) metal-ligand complex, and a long wavelength acceptor, e.g., Texas Red. The donor and acceptor can be covalently linked by, e.g., poly-proline spacers. The long lifetime donor results in a long lived component in the acceptor decay which is due to RET. The quantum yield of the luminophores approaches that of the higher quantum yield acceptor, rather than the lower quantum yield typical of metal-ligand complexes. The emission maxima and decay time of such tandem luminophores can be readily adjusted by selection of the donor, acceptor and distance between them. Luminophores with these useful spectral properties can also be donor-acceptor pairs brought into close proximity by some biochemical association reaction. Luminophores with long wavelength emission and long lifetimes have numerous applications in biophysics, clinical diagnostics, DNA analysis and drug discovery.

WO 02/07779 A1